Report for 2005MT56B: STUDENT FELLOWSHIP: The effects of recent watershed deglaciation, climate change, and microbial processes on nitrate loading and ecological response in high alpine aquatic systems of Grand Teton National Park

Publications

- There are no reported publications resulting from this project.

Report Follows

Project Title:

The effects of recent watershed deglaciation, climate change, and microbial processes on nitrate loading and ecological response in high alpine aquatic systems of Grand Teton National Park.

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Abstract:

The objective of this project was to build on a completed study of lake chemistry in the alpine zone of the Rocky Mountains and take into account the interactions of atmospheric deposition, change in runoff from glaciers and snowfields, and changes in the way soils and talus interact with precipitation and snowmelt. One initial step focused on the comparison of alpine lakes in both Glacier (GLAC) and Grand Teton (GRTE) National Parks and the selection of chemically sensitive lakes [acid neutralizing capacity (ANC) < 50]. Water chemistry from sensitive lakes would then be analyzed to compare the seasonal influx of nutrients during the snow and glacier melt periods. Finally, the source of nutrients (glacial meltwater, snowmelt, or atmospheric deposition) would be estimated based upon nutrient concentrations (specifically nitrate) in soil, ground water and surface water, atmospheric deposition and nitrogen-fixing plant material.

Research Accomplishments and Conclusions:

During Fall 2004, the USGS sampled lakes in both GRTE and GLAC (Nanus 2005). Comparison of these data with the data collected in 2002 at GRTE (Corbin 2004) emphasizes the sensitivity of GRTE lakes (Figure 1). The GRTE lakes have both a lower acid neutralizing capacity and more "leakage" of inorganic nitrogen than the lakes sampled in GLAC. In addition, National Atmospheric Deposition Program (NADP) trend diagrams of NO_3^- and NH_4^+ for Yellowstone National Park (YELL) at Tower Junction (Station WY08) show that significantly higher concentrations of both nitrogen sources are falling in the YELL area. Because GRTE and YELL are subjected to similar air masses, we have used the Tower Junction data as a surrogate for absent deposition data in GRTE (Peterson and Sullivan 1998). Therefore, lakes in the Teton Range may be subjected to larger concentrations of atmospherically deposited solutes than alpine lakes in Glacier NP.

To interpret these alpine lake data sets in National Parks and Wilderness areas of Montana and Wyoming, we will be carrying out an intensive, paired watershed study in Grand Teton National

Park. This headwater lake study will allow us to estimate the flux of nitrogen species from snowmelt and rain through two side-by-side watersheds - one with glacial melt and one without. We will incorporate detailed climate monitoring into the sampling program and have secured permits to install climate and deposition monitoring stations in the spring of 2006. In addition, snow surveys have been scheduled for March 2006 and will occur in conjunction with the USGS snow chemistry monitoring program (Ingersoll 2002). We are confident that this study should give managers valuable information on the dual stresses of air pollution and global climate change and their effects on lake water quality.

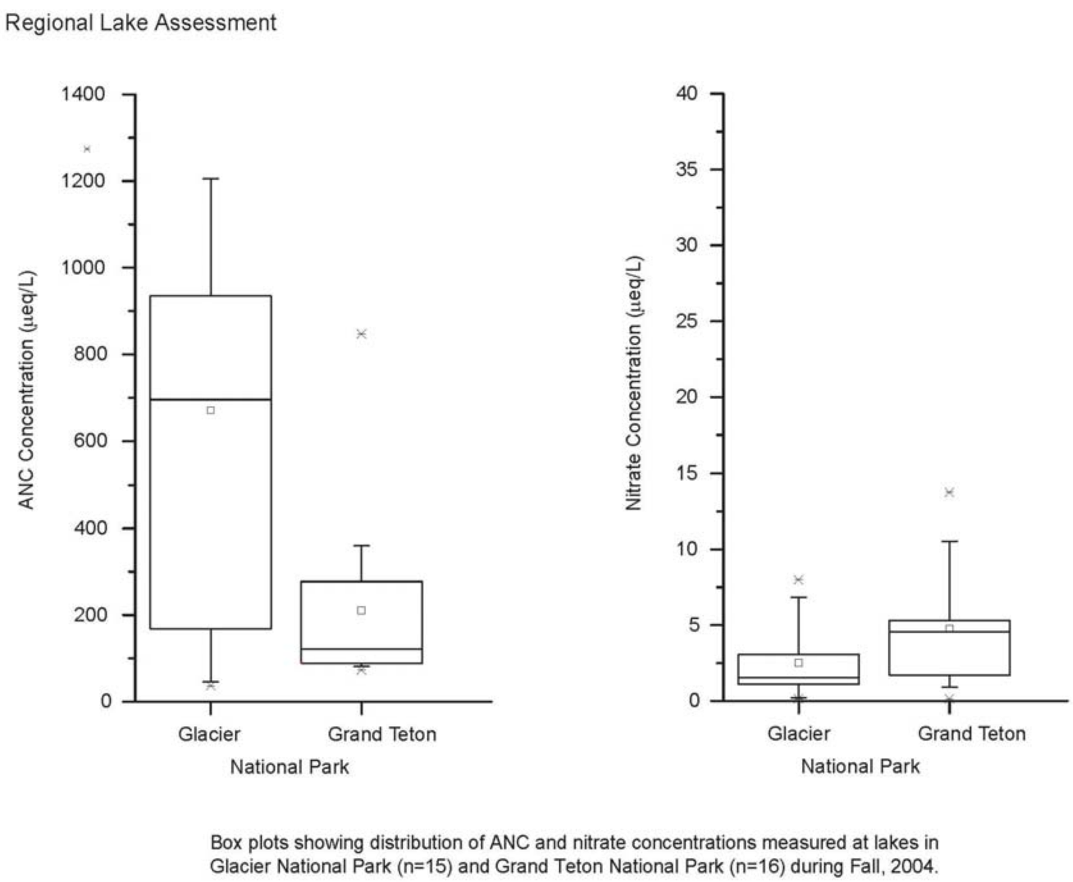

Figure 1 - Comparison of ANC and NO_3^- concentrations in Glacier National Park and Grand Teton National Park lakes (Reprinted with permission from Nanus et al. 2005).

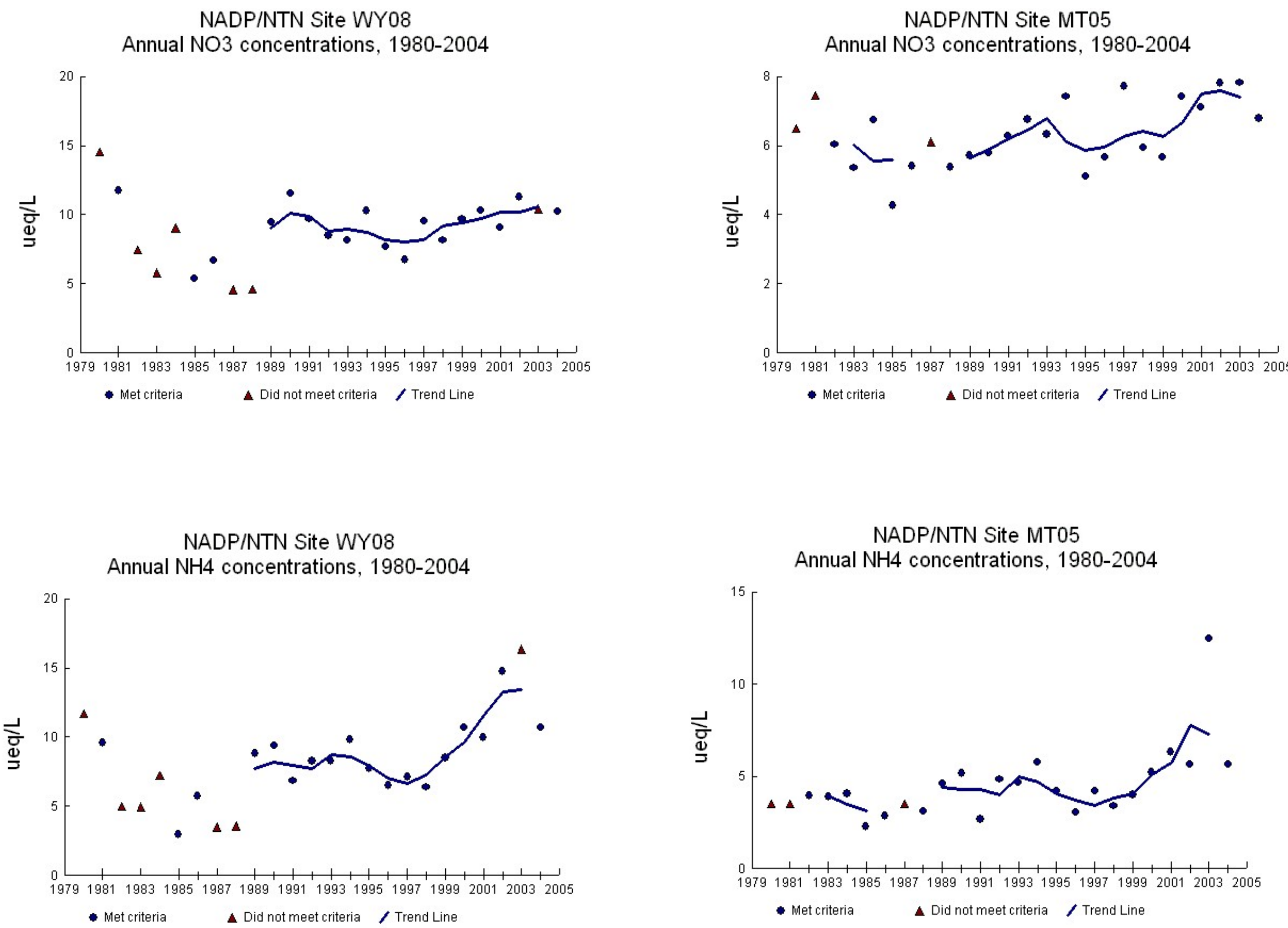

Figure 2 – National Atmospheric Deposition Program/National Trends Network (NADP/NTN) trend plots for NO_3^- and NH_4^+ in Yellowstone National Park (WY08) and Glacier National Park (MT05) (National Atmospheric Deposition Program 2005).

References

Corbin, J. 2004. The effects of atmospheric deposition on high alpine lakes in Grand Teton National Park, Wyoming. M.S. University of Montana, Missoula, MT.

Ingersoll, G. P., J. T. Turk, M. A. Mast, D. W. Clow, D. H. Campbell, and Z. C. Bailey. 2002. Rocky Mountain snowpack chemistry network; history, methods, and the importance of monitoring mountain ecosystems. Open FIle Report:2001-466, U.S. Geological Survey, Reston, VA.

Nanus, L., Williams, M.W., Campbell, D.H.,2005. Regional Assessment of the Relationship Between Landscape Attributes and Water Quality in Five National Parks of the Rocky Mountains. *Eos Trans. AGU, 86(52), Fall Meet. Suppl., Abstract H23D-1458.*

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Peterson, D. L., and T. J. Sullivan. 1998. Assessment of air quality and air pollutant impacts in national parks of the Rocky Mountains and Northern Great Plains. NPS D-657, U.S. Dept. of the Interior, National Park Service, Air Resources Division.